

REMARKS

Claims 1, 3-16, 18 and 19 are pending in the present application. Claims 16, 18 and 19 are withdrawn from consideration. No new matter has been presented.

Claim Rejections - 35 U.S.C. § 112

Claims 1 and 3-15 were rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement.

The Office Action takes the position that the specification does not support the full range of selectivity, *i.e.*, up to 100% selectivity. (Office Action, page 3.)

Applicants respectfully submit that the specification emphasizes the importance of “high selectivity” for CO and H₂ (*see, e.g.*, specification, page 5), and thus, one of ordinary skill in the art would understand that the specification implies that any selectivity above a certain threshold value is beneficial for the catalyst of the present invention.

Withdrawal of the § 112 rejection is requested.

Claim Rejections - 35 U.S.C. § 103

A. Rejection based on Wu

Claims 1 and 3-15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Wu (US 5,898,014). Favorable reconsideration is requested.

Applicants respectfully submit that Wu does not teach or suggest:

a catalyst for manufacturing synthesis gas containing carbon monoxide and hydrogen as principal ingredients from feedstock gas containing hydrocarbon having 1 to 5 carbon atoms in each molecule and oxygen,
[and]

wherein the selectivity of the catalyst for CO is at least 90.7% and for H₂ is at least 90.2%.

as recited in claim 1.

Based on the data in the Declaration submitted June 22, 2009, Applicants have established that a catalyst substantially equivalent to the catalyst in Wu does not satisfy the selectivity of the catalyst for CO and H₂ as recited in claim 1, and thus, Wu does not teach all of the elements as recited in the claim 1 either expressly or inherently.

The Office Action takes the position that “a catalyst which can achieve oxidation can be used for a process of partial oxidation if the reactants are given in an amount which only allows for such, for example a less than stoichiometric amount of oxygen.” (Office Action, page 5.) However, partial oxidation cannot be practically achieved by only adjusting the proportion of reactants to be fed into the reaction furnace. To the contrary conditions must be optimized for partial oxidation.

Ideally, partial oxidation is carried out at O₂:CH₄=1:2 (for CH₄+1/2O₂ →CO+2H₂). If the oxygen content is higher than the ratio, CO and H₂ once formed (even under the ideal progress of reaction) will be combusted to produce increased amounts of CO₂ and H₂O and lower the methane conversion rate. On the other hand, if oxygen content is lower than the ratio, the selectivity for CO and H₂ may be unchanged or even improved. However, even if the selectivity for CO and H₂ is improved, since the amount of oxygen necessary for the reaction is absolutely insufficient, the methane conversion rate will be lowered. Thus, even if the oxygen content is lowered to improve the selectivity, the production efficiency of synthesis gas will be lowered. In other words, a catalyst for partial oxidation must show a high methane conversion rate and a high

selectivity for CO and H₂ under the above ideal ratio of O₂:CH₄=1:2. In the examples of the present application, the ratio of O₂:CH₄:Ar=15:30:55 is employed. Please note that Comparative Example 15 demonstrates that a catalyst substantially corresponding to the catalyst of Wu (CeO₂:ZrO₂=50:50) shows a lower performance than the catalysts having a composition within the claimed range.

B. Rejection based on Niu, Yagi and Allison

Claims 1 and 3-15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over **Niu** (US 2003/0180215) in view of **Yagi** (US 6,376,423) and **Allison** (US 2002/0115730). Favorable reconsideration is requested.

Applicants respectfully submit that the present invention as recited in the claims provides unexpected results and thus, the molar ratios recited in the claims are critical. The results from the Examples and Comparative Examples as summarized in Tables 1 and 2, demonstrate that when the molar ratio of the second ingredient to the first ingredient and the molar ratio of the third ingredient to the first ingredient go out of their respective ranges, the conversion rate and the selectivity fall. (Specification, page 27.) The results also demonstrate that when the ratio of the third ingredient to the first ingredient increases, the CO and H₂ selectivity increase, but the methane conversion rate and the resistance against carbon deposition are not satisfactory. (Specification, page 27.) Additionally, the results demonstrate that when the ratio of the second ingredient to the first ingredient increases, the methane conversion is improved, but the CO and H₂ selectivity decrease and the resistance against carbon deposition is not satisfactory.

(Specification, pages 27-28.) Therefore, the results in Tables 1 and 2 demonstrate unexpected results and the criticality of the recited molar ratios of the carrier ingredients.

Applicants previously pointed out that the present invention as recited in the claims provides unexpected results. (Amendment, October 26, 2009, page 10.) The Office Action dated April 5, 2010 did not consider this argument and the cited data. Applicants request consideration of the data demonstrating that the present invention provides unexpected results.

For at least the foregoing reasons, claims 1 and 3-15 are patentable over the cited references. Accordingly, withdrawal of the rejections of claims 1 and 3-15 is hereby solicited.

In view of the aforementioned amendments and accompanying remarks, Applicants submit that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,
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